

MS 20500 Thermodynamics of Materials

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Office Hours	Wednesday 10:00-12:00 pm	Class	Tue 10:10-12:00 pm Thurs 10:10 am-11:00 am

Suggested Textbook:

Introduction to the thermodynamics of materials, 6th Ed, David R. Gaskell and David E. Laughlin, Taylor & Francis, 2018, ISBN 978-1-4987-5700-3 偉明圖書代理

Description:

Thermodynamics is the branch of physics concerned with **heat** and **temperature** and their relation to **energy** and **work**. The behavior of these quantities is governed by the laws of thermodynamics, irrespective of the composition or specific properties of the material or system in question. **The laws of thermodynamics** are explained in terms of macroscopic constituents by statistical mechanics. Thermodynamics applies to a wide variety of topics in science and engineering, especially physical chemistry, chemical engineering, and mechanical engineering. With these tools, thermodynamics can be used to describe **how systems respond to changes in their environment**. This can be applied to a wide variety of topics in science and engineering, such as engines, phase transitions, chemical reactions, transport phenomena, and even black holes. The results of thermodynamics are essential for other fields of physics and for chemistry, chemical engineering, aerospace engineering, mechanical engineering, cell biology, biomedical engineering, materials science, and economics, to name a few. (from Wikipedia)

本課程分兩學期授課,上學期先介紹熱力學三大定律及各種熱力學函數,熱容量、熵、焓及自由能,並討論單相氣體及凝態系統之熱力學性質。接著從統計熱力學解釋熵之微觀意義,以及配分函數與自由能之關係式,舉例說明其應用於熱容量之理論推導。下學期則介紹氣體及溶液的行為,理想與真實溶液之性質,二元相圖與自由能之關係,化學反應之平衡觀念,以固態材料系統為對象,探討其化學反應及相轉變所需考量之熱力學觀念。

Topics:

Thermodynamics II

- Phase equilibrium in a one-component system (Ch7)
- The behavior of gases (Ch8)
- The behavior of solutions (Ch9)
- Gibbs free energy composition and phase diagrams of binary systems (Ch10)
- Reaction involving gases (Ch11)
- Reactions involving pure condensed phases and a gaseous phase (Ch12)

Course Schedule:

Week	Topic	Required Reading
1	Phase equilibrium in a one-component system	Ch7
2	Phase equilibrium in a one-component system	Ch7
3	Phase equilibrium in a one-component system	Ch7

4	Phase equilibrium in a one-component system	Ch7
5	Phase equilibrium in a one-component system	Ch7
6	The behavior of gases	Ch8
7	The behavior of gases	Ch8
8	The behavior of gases	Ch8
9	4/15 (Tue) Midterm Ch7-8	
10	The behavior of solutions	Ch9
11	The behavior of solutions	Ch9
12	The behavior of solutions	Ch9
13	The behavior of solutions	Ch9
14	Gibbs free energy composition and phase diagrams of binary systems	Ch10
15	Gibbs free energy composition and phase diagrams of binary systems	Ch10
16	Gibbs free energy composition and phase diagrams of binary systems	Ch10
17	Gibbs free energy composition and phase diagrams of binary systems	Ch10
18	6/10 (Tue) Final exam Ch9-10	

Evaluation:

☐ Quiz 1	3/20 (Thurs)	15%	☐ Quiz 2	5/15 (Thurs)	15%
☐ Midterm	4/15 (Tue)	30% or 40%	☐ Final	6/10 (Tue)	30% or 40%
☐ TBL	TBA	25% (Extra)			

No class: 4/3 春假、4/17 (Wed) 期中考週。

- TBL 額外加分提供學期成績不及格同學(<60)加分用，如無參與 TBL 活動則無法加分。
- TBL 計分方式：依照四次 TBL 表現，分組互評 15 分、出席及個人表現調整 10 分。
- 分組互評(15 分)，依照期末 TBL 成績排名依序得到 15, 14, 13, ... 6 分。
- 出席及個人表現(10 分)，老師依照 TBL 活動個人表現給予分數。
- Microsoft Teams 團隊代碼：vzv2ka請使用 ndhu gms 登入後加入團隊
- Resources：enotes、handouts、ZUVIO、Youtube online courses、演習課、TBL、自主學習評估表。
- 課程錄影影片：<https://youtube.com/@user-rr4nk9nd4f>
- 學期成績計算方式已提供期中期末彈性計算分數與 TBL 加分方式，沒有其他的補救措施。